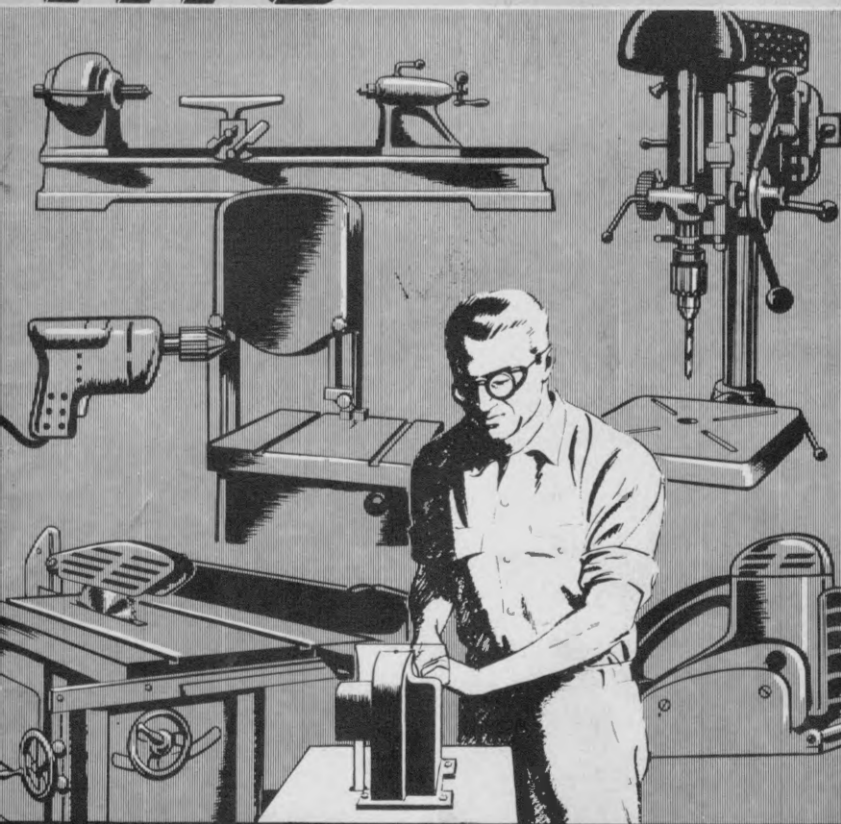


TIPS ON USING POWER TOOLS



REPRINTED FROM
Better Homes & Gardens Handyman's Book

How to use a portable electric drill

If nothing seems to get done around your home, and you blame it on your tools, maybe what you need is a portable electric drill.

Here, in one tool, is the versatility required by the home handyman who may mend a toy one day, repair a roof gutter the next.

You need no special skill to use an electric drill. It is designed for one-hand operation, is light in weight, and is shaped with pistol grip. You can use it anywhere you have access to house current. To change it from one tool to another, you merely release the chuck that holds the accessory, replace the accessory, and close the chuck. The more you use your drill, the more uses you'll add to those suggested here.

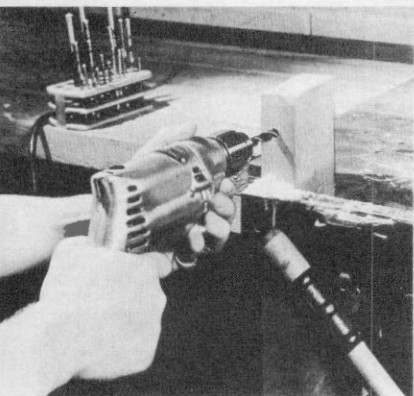
For most home uses, examine the light- and standard-duty portable

drills designed for the amateur. They cost around \$15 and up, with power and price increasing as the speed decreases. The most common chuck holds shafts up to $\frac{1}{4}$ inch in diameter, with adapters for accessories.

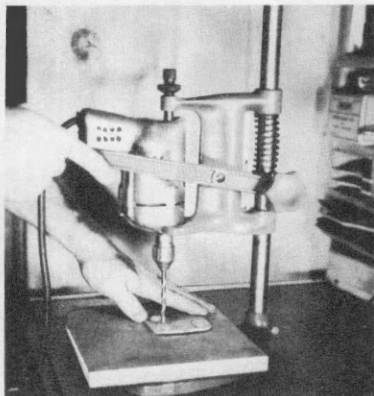
You have your choice of a vast number of accessories, from small bits and grinders at less than \$1 to major converters beginning at about \$10. Your choice may be a kit containing the drill plus an assortment of standard accessories. Look, too, at the vertical and horizontal stands that will hold the drill stationary.

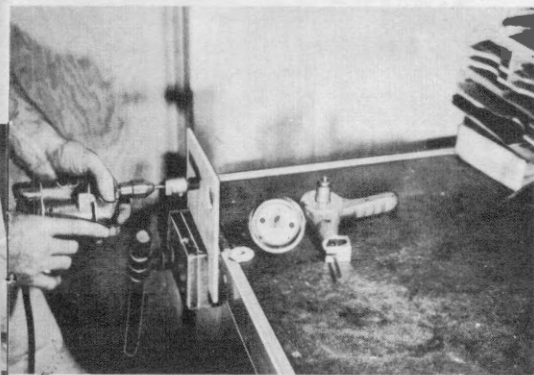
Specifically for the home hobbyist are small, featherweight, high-speed drills, handy for dozens of precision jobs in woodcrafting, model building, jewelry making, and electrical hobbies. These tools may be purchased for \$10 and up.

Wood drilling. Basic purpose of drill is to bore clean holes quickly in wood, metal, and masonry. Here, a $\frac{3}{8}$ -inch drill bores a bolthole. With special bits, you can drill up to 1-inch holes in wood. Avoid rough break-through by releasing pressure on the drill before bit grabs the last chip.



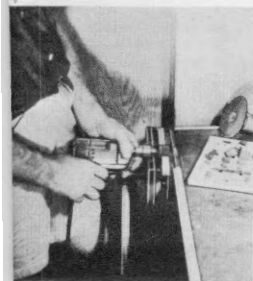
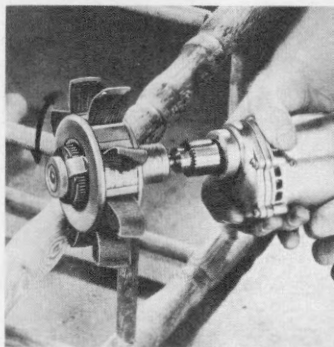
Metal drilling. For metal drilling, use high-speed steel bits; they'll work in wood, too. Lubricate as directed to control friction heat. Drill only up to rated capacity; for larger holes, use a hole saw. Vertical bench stand aids precision work, and frees one hand to guide the work.





Sawing. Hole-saw attachment like this will cut holes up to two inches in diameter neatly and quickly. A small guide drill in the center helps you locate holes accurately. Still another attachment converts rotary action to back-and-forth action. It holds stiff saw blades that will make straight or pattern cuts in wood, metal, linoleum, wallboard.

Sanding. A sanding attachment for your electric drill will save you many hours of hand-work. The merry-go-round gadget on the drill at right is one of the more unusual of the attachments you can buy for sanding. Bristles project from the rim to support strips of abrasive cloth, which may be turned out and clipped off as they become worn. Because of its flexible brushes, it sands irregular surfaces.

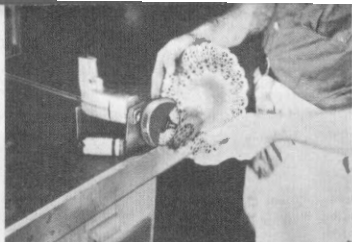


✦ **Sanding drums.** The kit pictured will ease small jobs of grinding and smoothing. It contains abrasive-paper sleeves with various grit sizes to suit the job at hand, plus a series of small sanding drums you can clamp in the drill's chuck. In the background is a rotary-action converter with a flexible rubber backing, to which you can cement sandpaper.

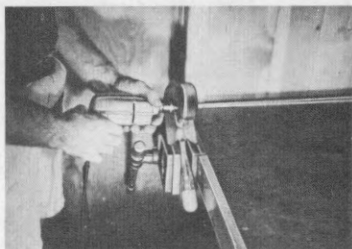
✦ **Flat sander.** This flat-sanding attachment converts the natural rotary action of the drill to an oscillating motion for sanding. It does an extremely smooth finishing job, polishes wax, too. It has quickly detachable pads sized to hold sections cut from regular sheets of abrasive paper or cloth, depending on job.



Cleaning. Removing tarnish from silverware, jewelry, or brass is an easy job for the drill. Use a rag buffing wheel plus a polishing compound for a bright finish without scratches. The inexpensive horizontal stand shown holds the drill firmly and frees both hands for guiding the work. Peg in the handle of the drill locks trigger so motor runs until the trigger is released.



Scraping. To whisk away rust, scale, oil paint, or even to clean up that fire-blackened coffee-pot, check upon the numerous brush accessories available for your hand drill. Here, a coarse wire brush cleans a rusted garden trowel. Finer wire brushes can be used to put a satin finish on metals or to clean stubborn spillovers from the kitchen range.

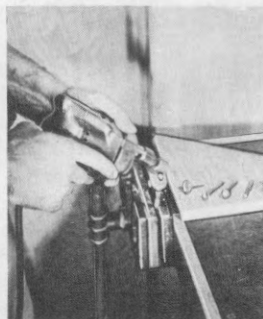
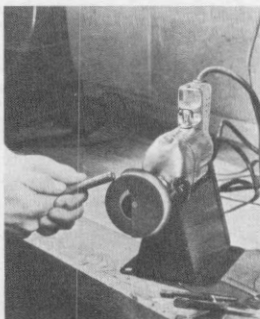


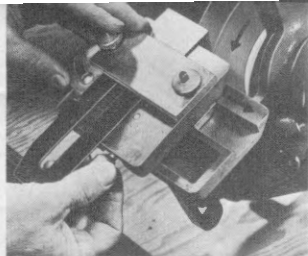
Sawing. If you are still unconvinced that the drill is a versatile tool, this attachment should clinch the argument. It's a power saw that can whip through light stock in no time, giving a clean, accurate cut with a minimum effort. An adjustment can be made to permit angle cuts as well as depth of cut. As with all power drill accessories, make sure ground wire is attached before using.



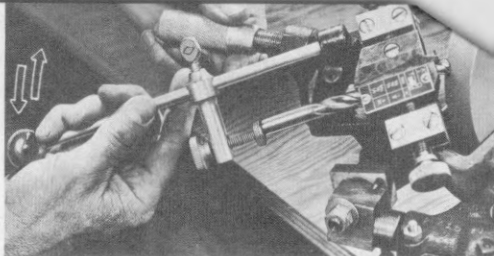
Polishing. For a bright, durable shine on furniture, floors, car, or even shoes, buff wax with plastic or rubber disc covered with a lamb's-wool bonnet. If backing disc is flexible, you do a better job on curves. Keep drill moving; for high luster, tilt slightly to take advantage of the dry outside edge of bonnet.

Grinding. Such jobs as taking burrs off head of cold chisel can be done with grinding wheel (center). Wear goggles. More elaborate attachments have slotted racks for sharpening edged tools. You can smooth metal edges with file attachments (right), available in many shapes.





Sharpening plane irons. This sliding clamp adapts bench grinder for sharpening plane irons, chisels. Set front rest at correct angle, turn knob to feed.



Sharpening drills. Drill grinder attachment is handy for use with a bench grinder. Many skilled mechanics can't sharpen a twist drill properly by hand, but any amateur can do a factory-finish job with this jig.

How to use a bench grinder

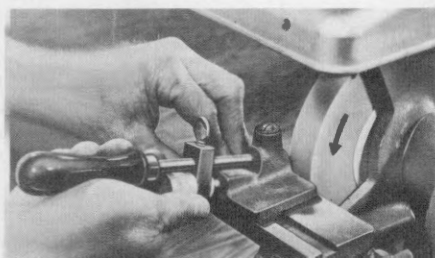
High on anyone's list, even if he has no other power tools, is a combination grinder and buffer. With this tool, all cutting edges can be kept keen, and hand tools can be buffed and polished clean.

When you set out to buy a grinder, you'll have a smorgasbord choice. There are low-cost spindle heads, to which you can add shaft, stone, buffer, pulleys, belt, and a motor. You end up with an acceptable combina-

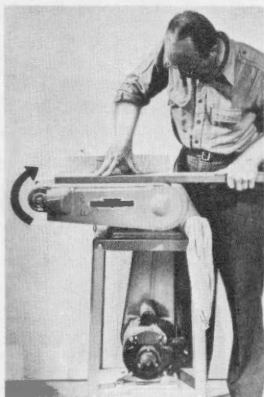
tion which may cost you no more than five dollars, not counting the motor. The advantages you'll get with more expensive outfits include precision bearings sealed against abrasive dust, sturdier construction, guards around wheels and between wheels and your eyes, tool rests, and special attachments for precision grinding of such things as drills and plane blades. Some grinders are powered by drive belt to the motor.

Safety first. This grinder is adequately equipped with wheel guards. But unless your grinder has shatterproof glass eye shields built into its guards, get a pair of approved safety goggles. And never neglect to put goggles on when you use grinder or buffer. Clear plastic face shield, good for wood-working machinery, is not enough protection at grinder.

Truing stone. Worn grindstones can be cut into shape. This clamp holds a diamond-tip dresser which will true wheel in a few seconds. A less costly dresser consists of a holder with several hard-steel stars. Star points are held against spinning stone; stars can be replaced when worn.



How to use abrasive power tools



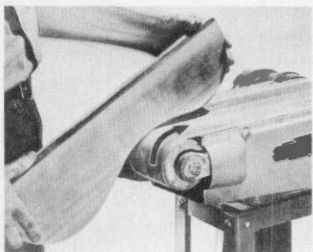
Bench belt sander. One useful abrasive power tool is the bench belt sander. The two whirling cylinders, one power-driven, carry an abrasive belt over a fixed table (the platen). This belt sander is smoothing a long board; the side fence is used to guide the board. The sack is an old sleeve tied at the lower end.

There's one "forgotten" tool in every workshop—the abrasive. It's easy to see a power grinder as a tool. But a sheet of sandpaper, a stick of rouge, a handful of powdered pumice stone? Tools?

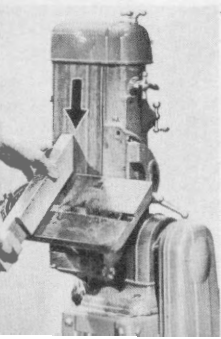
Actually, they are. When rubbed against a softer material, they wear it away, with the result that the surface is smoother or polished.

You can work abrasives by hand, or you can let a power tool lay on the grit—with five times the speed and ease.

With a sanding attachment, the electric drill is an abrasive power tool. The bench grinder is another. Here are the more specialized types of abrasive power tools, with tips that will help you use them.

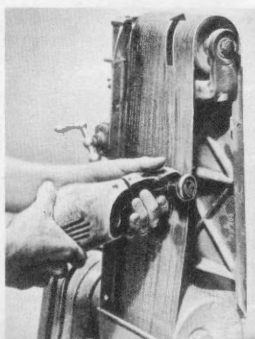


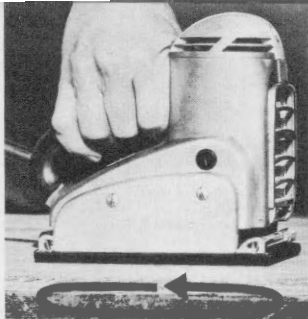
◆ **Drum sanding.** By removing the pulley guard to expose the curved surface of the end cylinder, you can do drum sanding on a bench belt sander. Garnet-cloth belt, best for wood finishing, is used here. For grinding metals, use either a silicon-carbide or an aluminum-oxide belt instead. All abrasives are made up of number on number of small grains of some hard material with sharp cutting surfaces. The action of each separate particle is like that of a chisel; each grain cuts its own tiny shaving of wood or metal or plastic, thus smoothing or polishing the surface.



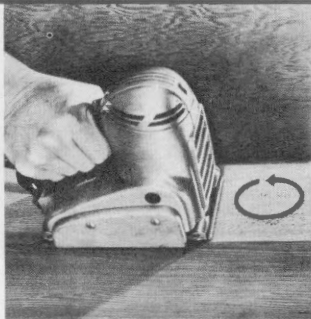
◆ **Edge sanding.** You can sand edges at right angles, or at any angle up to 45 degrees on adjustable table when belt sander is tilted upright. Knobs at right adjust the belt tension and keep belt centered on the cylinders.

◆ **Double curves.** To smooth double curves like those on a shoe tree, use belt sander without the platen. Remove back guard and slit belt as pictured; leave unslit portions every three or four inches to hold belt together.

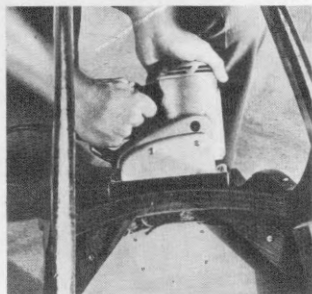




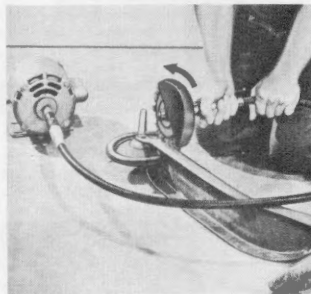
Jitter sander. This abrasive power tool, the jitter sander, has a foot that jitters back and forth or describes an oval. It leaves few scratches, so it is good for final finishing. It is not intended for fast surface removal, as is the belt sander.



Inside corners. Jitter sander handles inside corners and raised edges without difficulty. Square foot sands right to the joint. Use it with a flexible pad when feathering dents and scars; tilt slightly so only one corner contacts the marred area.

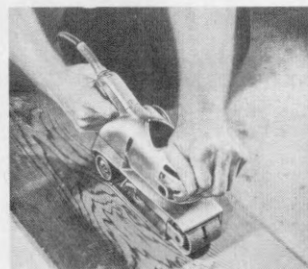


Curved surfaces. You can smooth curved surfaces with the aid of a thick pad of sponge rubber on a jitter sander. For this between-coats job, the fine silicon-carbide paper was soaked in water to float away gummy residue which might clog paper.

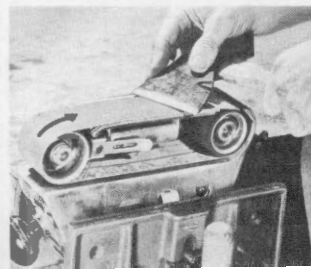


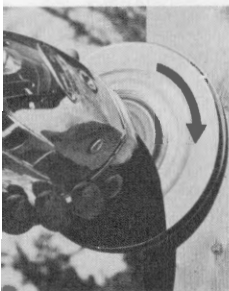
Flexible shaft. The flexible shaft is not an abrasive power tool in itself, but it can be used to carry power from a heavy motor to inaccessible places. Grindstones, abrasive discs, wire wheels, and fabric buffers can be attached to the shaft end.

Portable belt sander. Belts for this portable sander are made in all standard grit sizes and materials. It's a tool for cutting more than smoothing, so final hand-sanding is advisable for a perfect finish on wood.



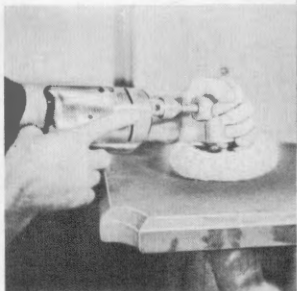
Grinding. Portable belt sander becomes a tool grinder when you clamp it in a bench vise and equip it with aluminum-oxide or silicon-carbide belt. Here, it removes burrs from hatchet prior to honing.





← **Sander-polisher.** Disc sanding attachment on a sander-polisher does a quick job of leveling rough wood. As the cutting path is circular, hold disc so it touches wood where curve will be near line of the grain, thus minimizing cross-grain scratching.

Furniture polishing. Waxing furniture with a sander-polisher takes about one-fifth the effort of hand-polishing. Lamb's-wool pad polishes to a mirror finish. For auto waxing, use an applicator pad with a pile like a coarse rug to remove the grime.



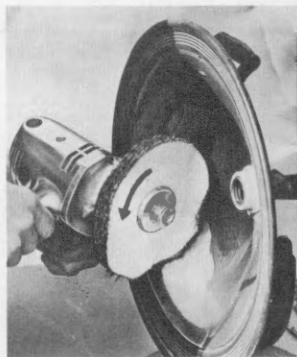
← **Sanding concrete.** Sander-polisher, equipped with a silicon-carbide disc and a flexible backing disc, is being used here to level an uneven patch in a concrete floor. You can convert a sander-polisher for drilling by adding a chuck, or equip an electric drill with discs for sanding and polishing.

Floor polishing. A floor polisher → results when the sander-polisher is equipped with a handle. Bristle brush and a wet paste of fine-grit cleanser remove scuff marks and dirt from asphalt tile floor. A spreader pad applies the wax, as pictured; then a buffing pad does the polishing.



← **Buffing metal.** Metal objects that have been scratched or scorched can be buffed into beauty again with a fine-wire wheel, here used on a sander-polisher. Use care so the lines from buffing all flow in the same direction, and don't press the wheel into soft metals so hard it digs pits.

Polishing metal. A glassy finish for → surfaces such as this heater reflector is attained with a fabric buffing wheel and rouge abrasive. In the case of a heater, a high polish increases the efficiency. Abrasive rouge can be bought in stick form, to be laid on the fabric wheel while spinning.



How to use a circular saw

Usually the first power tool a serious amateur craftsman buys is the circular saw. It has a fast-moving circular blade with teeth around the edge, and is the best machine for sawing a perfectly straight line.

It can make a variety of other cuts, too—miters, compound miters, grooves, bevels, spirals, coves, moldings. With the right blades or abrasive wheels, it can be used to work metals, plastics, bone, or stone. You can turn it into a fair disc sander or grindstone.

Most circular saws designed for home workshops have blades 6, 7, or 8 inches in diameter; the 8-inch size is by far the most versatile. Prices range amazingly, from around \$35 without motor to nearly \$300 with motor, depending on size, precision of manufacture, and accessories.

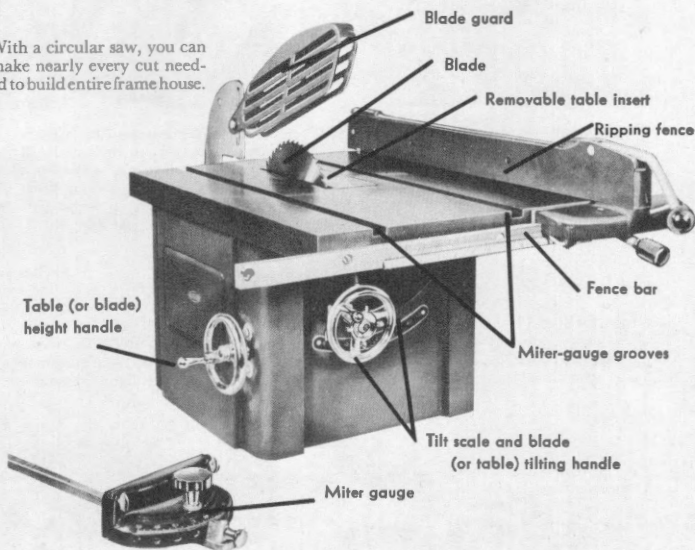
In both floor and bench saws, the circular blade has a $\frac{1}{2}$ - or $\frac{3}{8}$ -inch hole in the center, and is attached to an arbor which whirls it. Depth of cut is determined either by raising and lowering the saw table, or by raising and lowering the saw blade.

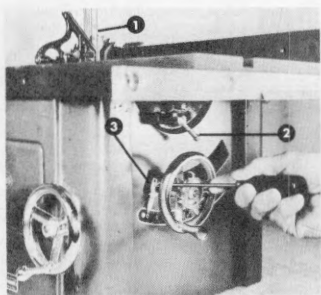
Most lower-priced saws have tilting tables for bevel cutting. But a few of them, and nearly all of the higher-priced saws, have tilting arbors. In that type, blade pivots and locks at any angle up to 45 degrees.

Primarily for ripping long boards is the fence, a long, rigid guide parallel to the blade. Crosscutting and mitering are done with the aid of the sliding miter gauge.

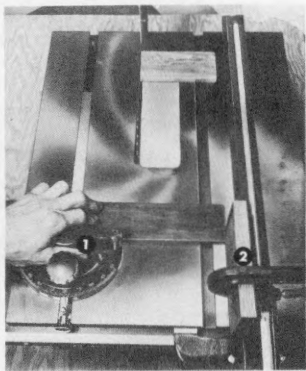
Besides common bench and floor saws, there are special types—swing saws, cutoff saws, power handsaws, radial-arm saws, sliding-table saws.

With a circular saw, you can make nearly every cut needed to build entire frame house.

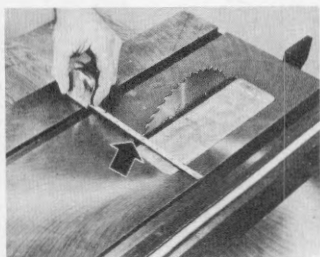




Adjustment. To correct the tilt scale, use a try square or combination square to set blade and arbor at right angles to table (1), then lock them with lever (2). Next, loosen scale pointer (3) and set it at zero.



Crosscutting. Hold stock tightly against miter gauge (1), fingers safely back. This setup, with block (2) clamped to fence, helps cut many pieces of same length. Don't use fence itself as length gauge.

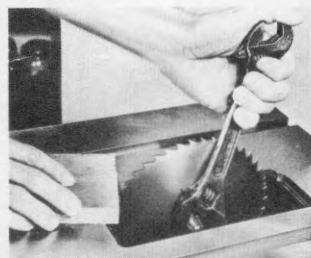
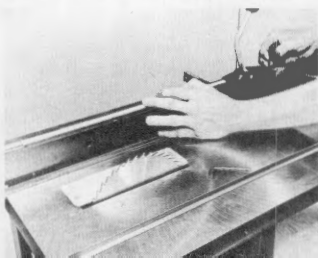


Check table. Table must be parallel to blade. To check, measure from miter-gauge groove to blade (with blade in highest position) at front and rear. If measurements differ, loosen the table-mounting screws, and tap the table lightly into alignment.



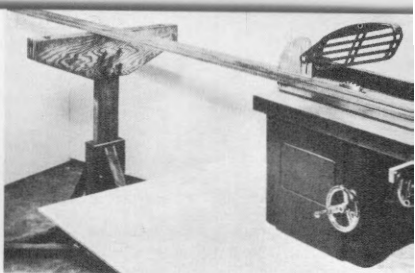
Check miter gauge. One way to check miter gauge is with try square. Another (shown) is to crosscut wide board with gauge at zero, then turn board over. Any gauge error causes an angle (A). Move miter-gauge head *one-half* of the angle.

Check fence. Ripping fence must also be parallel to blade. Check it (after aligning table with blade) by locking fence with edge along miter-gauge groove. If fence is not parallel to groove, loosen fence bolts, align fence. Also check the board-width pointer.

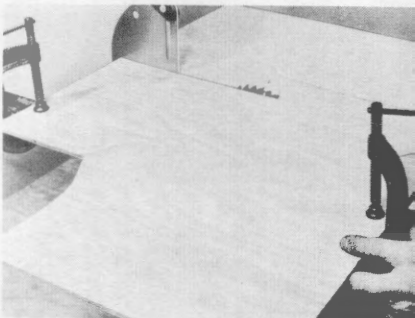


Blade change. To remove or replace blades, disconnect motor and use a block of wood to keep blade from turning while you move arbor nut with wrench. Nut needn't be tightened drastically; it can be secured with very light pressure on tool.

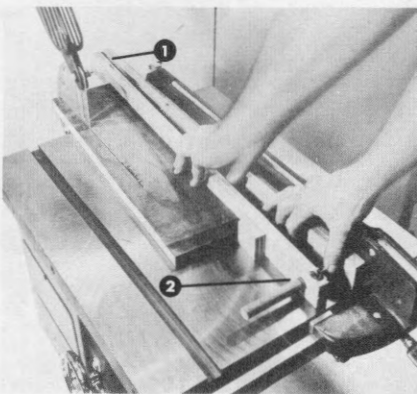
Ripping long boards. Ripping operations that require long, continuous feed should be handled carefully. Hurried feed may stall or overheat motor, too-slow feed may overheat blade. About one tooth-depth of blade should project above board. (Here, blade is elevated higher than normal, and guard is raised, to show shape of ripping-type teeth.) Push stick is a safety measure. Roller support takes place of an extra person in supporting end of long board. Warped, twisted, or dished boards must be ripped with extra caution, since they may bind blade and kick back.



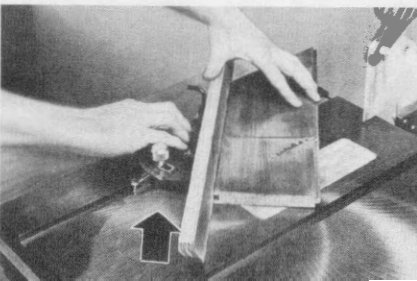
Wide panels. Most circular saws allow for ripping of wide panels by the addition of table or fence-bar extensions at extra cost. However, occasional panel ripping can be done without accessories as shown here. Clamp a long, straight board to the panel underside at the desired width plus the distance from blade to table edge. This board becomes an auxiliary fence, slides along edge of table to guide cut accurately. When ripping, stand slightly to one side, out of line of blade. Crosscutting and ripping blades are different, but a sharp combination blade does both jobs.



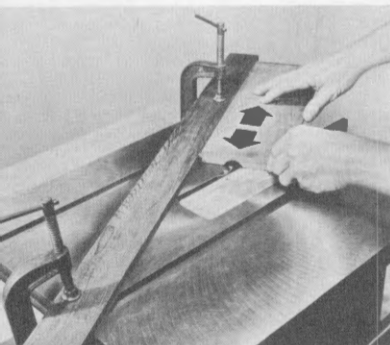
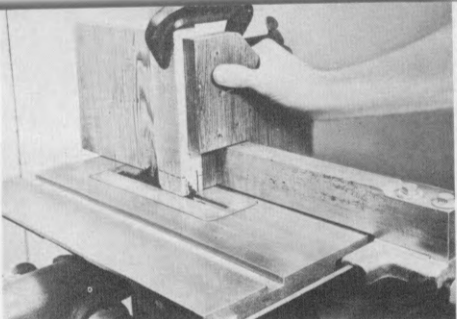
Tapers. To rip tapers, you'll need a jig like the one shown. Make it of dry lumber or plywood thick enough to stay straight. Hinge one end (1), and arrange a locking device (2) near the other end with which to set the angle of taper. Lock may also be marked to indicate the amount of taper per foot. In crosscutting, never use the fence as a length gauge; pieces cut off might jam. Unless blade, table, and fence line up perfectly, wood may wedge against blade and kick, or be thrown violently out of the saw. A 10-inch blade will cut to a depth of $3\frac{1}{4}$ inches, 8-inch blade to $2\frac{1}{4}$.



Mitering. Mitering most often done is at 45-degree angle shown. Because of angle, work creeps more readily than in square cuts, must be held very tightly. An aid to accuracy is the longer, auxiliary strip of wood screwed or bolted to the gauge face. Sharp-pointed brads, driven into the rear of wood face until points project slightly on forward side, prick into work and help keep it from sliding. A hollow-ground blade is often used for mitering because it leaves a very smooth cut desirable for clean jointing. Compound miters are cut with the gauge and the blade tilted.

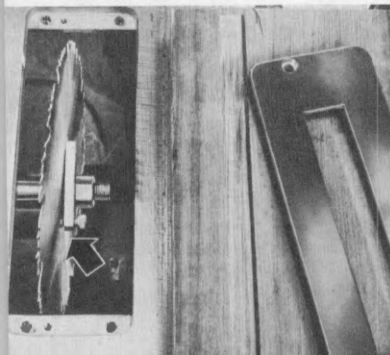
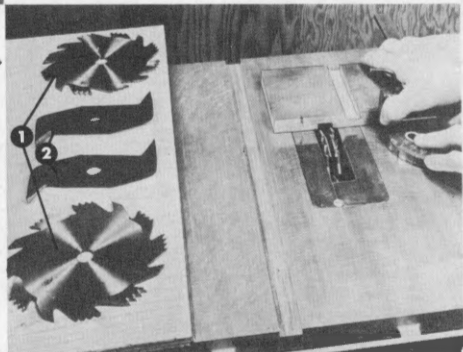


Tenons. If you lack a dado head or a straight-knife molding cutter, cut tenons with ordinary blade and a homemade jig. Make vertical cuts with jig first; then use miter gauge to crosscut the shallower shoulder portions. You can mount two blades to make both the vertical cuts at once.

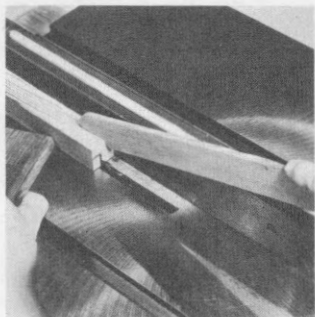


✦ **Coves.** Concave curves or channels are obtainable with an ordinary blade. They are made by passing the stock, in repeated cuts of slightly increasing depth, diagonally across the blade. To find the angle necessary for width of cove wanted, mark the desired cove curve on the end of a board, then lay it on the saw table and sight past blade until blade and curve coincide. Next, without moving sighted piece, clamp a board next to it to serve as a fence along which it can slide. Start cutting with blade about 1/16 inch above table; raise blade 1/16 inch for each successive cut until proper depth is reached.

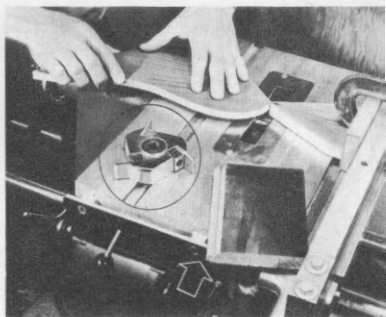
✦ **Dado head.** Dadoes are simple rectangular channels cut across or the length of a board. They can be made with repeated passes over an ordinary blade, moving the work aside one blade width each pass. But it's faster and cleaner to use a dado head. Such a head is made up of a group of blades—two outer discs (1) exactly alike, with chipper blades (2) of varying thicknesses to sandwich between until desired width of dado is obtained. Paper washers are used to space out precise in-between widths.



✦ **Wobble washer.** Using an ordinary blade and a "wobble washer," dadoes of varying widths can be cut without removing or adding chippers or paper washers. The adjustable washer replaces the regular arbor washers on each side of the blade, and is set to throw the blade off square on shaft, producing a side wobble that varies as to the pitch of blade and turns out a correspondingly wide dado.

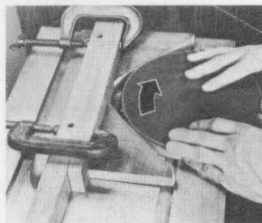


Rabbet cut. A rabbet (square step cut into an edge) is made in two cuts. First cut, already made here, should be slightly less than depth of finished rabbet. Second cut is marked on end of piece. Dado head or molding-cutter head with straight knives makes a rabbet with only one cut.

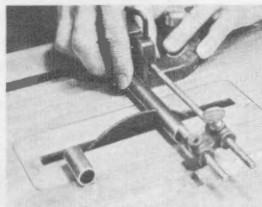


Moldings. To shape moldings, replace blade with a molding-cutter head, containing knives ground to same shape. Irregular curved edges, like sample being cut, need one-point triangular guide. Straight edges (arrow) are fed over cutters with the fence as a guide.

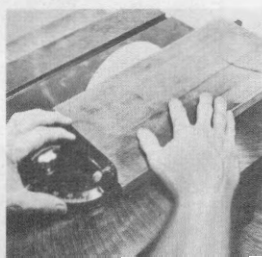
Molding circle. With the molding-cutter ➔ head on the circular saw, you can shape moldings of every conceivable curved, angular, or combined shape. When you are giving a circular piece a molded edge, you need a guide with two contact points, as pictured. Since the blade guard is never used with a molding cutter, extra care is needed in guiding work to avoid accidents. Knives must be very sharp.



Cutting metal. Replace the usual blade with ➔ an abrasive cutting wheel and circular saw will cut metal or stone. Here wheel is cutting copper tubing, guided by the miter gauge. Gadget projecting from miter gauge, called a "stop rod," is used to obtain many duplicate lengths of any material without measuring for each cut. This is a more accurate method than clamping a block to the fence as length guide.



Sanding. Cement sandpaper or garnet paper ➔ to a thin plywood or plastic disc and your saw becomes a disc sander. For added stiffness, you can use the saw blade to back up sanding disc. Disc will spin at normal saw speed of more than 3,000 rpm, so feed work slowly. Too much pressure may burn the wood or ruin abrasive.



How to use a drill press

Among home workshop machines, the drill press is most versatile. In addition to drilling, it does such jobs as grinding, polishing, sanding, shaping, joining, surface planing, tenoning, mortising, routing, carving, and dovetailing.

You can stir paint with a drill press. Or block-print Christmas cards. Or do some pressure-gluing jobs.

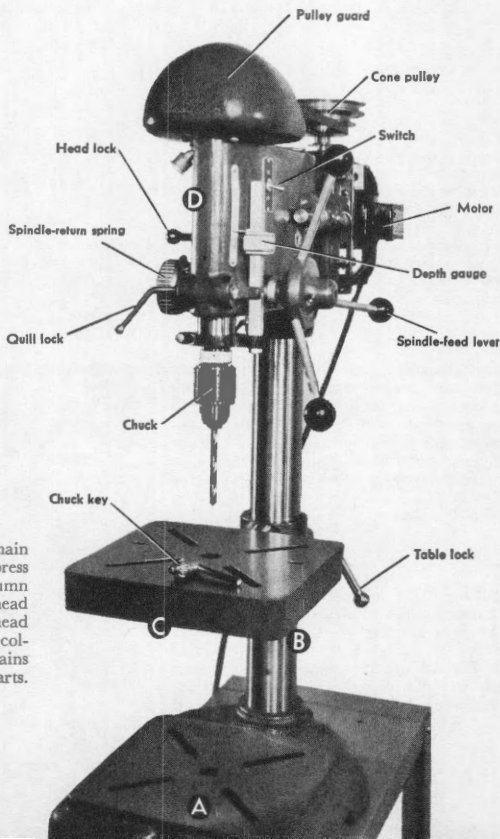
Heart of the drill press is the spindle, a shaft driven from the top by a pulley. At the bottom end of the spindle is the chuck, a clamping device to hold drills.

A steel sleeve, called the quill, supports the spindle. A hand lever, mesh-

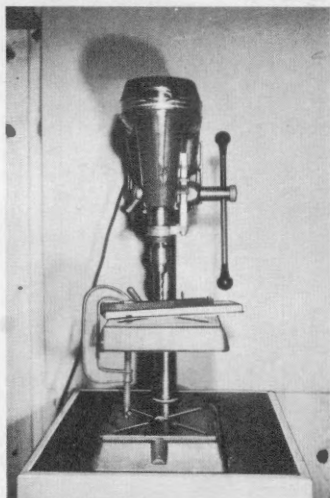
ing with teeth on quill, raises and lowers quill and spindle to press the drill into the work. You can lock press for routing, sanding.

Size of a drill press is designated by twice the distance from spindle center to the edge of the upright column. Thus, a 15-inch press will be $7\frac{1}{2}$ inches from column to spindle center. Commonest sizes are between 11 and 15 inches, will drill up to $\frac{1}{2}$ -inch holes in metal, 2-inch holes in wood.

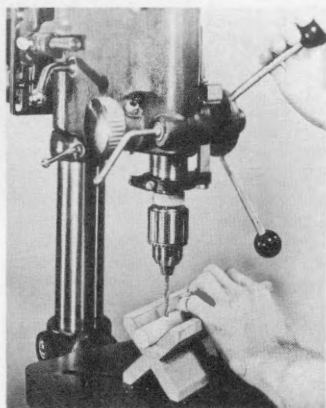
You can buy a floor-type drill press, or one with a shorter column to mount on your workbench. Not including the motor, you can pay from around \$30 to more than \$100.



Main parts. The main parts of a drill press are: base (A), column (B), table (C), head (D). Table and head slide and pivot on column. Head contains motor, working parts.



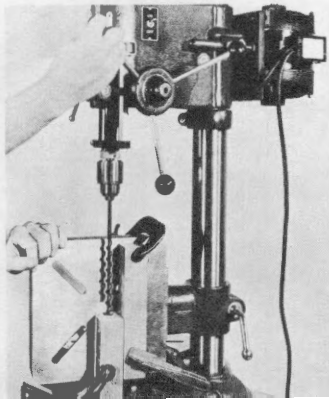
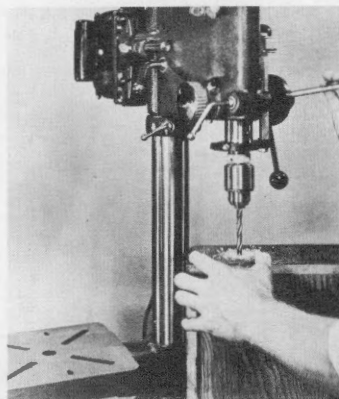
How to drill. To avoid marring table with drill point, use wood block beneath work; set depth of stroke so drill stops short of table. Clamp work to table if possible. Use carbon-steel drills for wood and soft metal, high-speed steel drills for hard metals and plastics. To put drill bit in chuck, twist chuck until jaws open. Insert drill shank, center it, and tighten firmly with chuck wrench. Never start press with the chuck wrench in chuck.

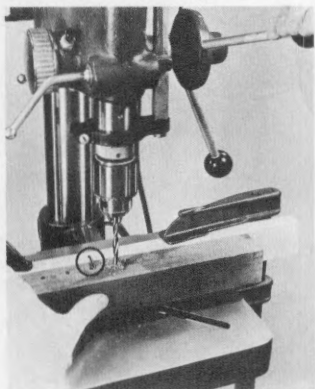


Cylinders. Any cylindrical object to be drilled must be supported so it won't roll sideways. A V-block or an X-shaped block like this will hold it. Make block of hardwood if possible, and use a clamp on all but smallest holes or softest materials. Feed lightly and hold the work firmly; then the absence of any side wobble as you drill will make broken drill bits a rarity in your workshop. Keep drills sharp for accurate work.

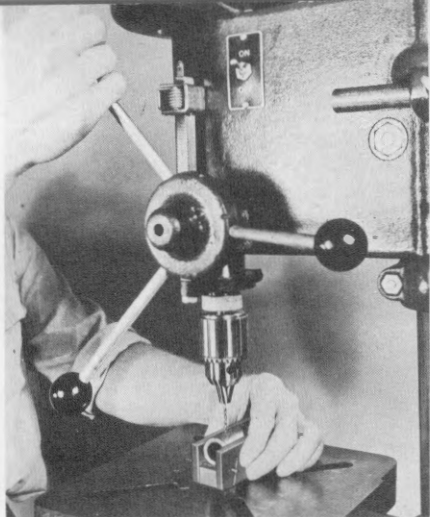
Large pieces. Sometimes work to be drilled is higher than the greatest available distance from spindle end to table. When that happens, swing table aside, and let press base (or even the floor) serve as the table. If necessary, block work into correct alignment, using column protected by wood blocks for clamping. But be careful not to mar the smooth surface of the column, or the sliding table might bind. Here, holes are being drilled in a drawer front for attaching pulls.

Long work. Long pieces to be drilled on end can't be laid on the table. Instead, turn the table to its vertical position, and swing head and table to the side of the bench. Now clamp the work to the table in proper alignment. Note the guide block. Since the longest stroke on most presses is 4 inches, work must be advanced by stages. Chips don't rise readily out of a deep hole; remove and upend work occasionally to tap out cuttings. Use slowest belt setting for this type of work.





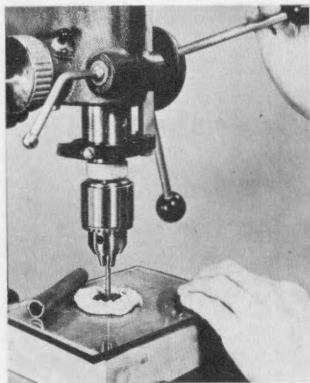
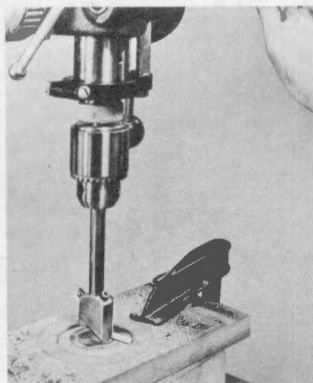
Spacing holes. Simple jigs save time and insure accuracy when you drill many duplicate pieces or space many holes in a single piece. Here, a fence with a fixed pointer (nail bent to overhang work) is used to space a line of holes.

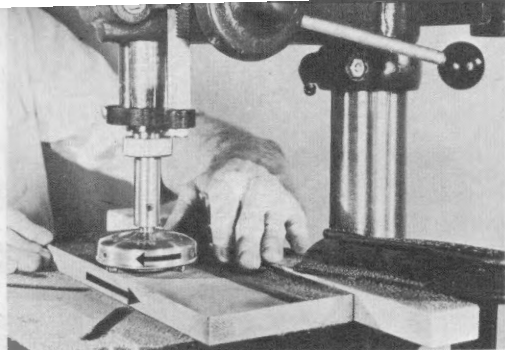


Tiny holes. It's easy to drill tiny holes ($1/16$ inch or less), since chuck does not wobble. Feed lightly at top speed so you don't break delicate drill. Raise drill often. Never chuck a small drill so deep that chuck jaws grip the cutting edges.

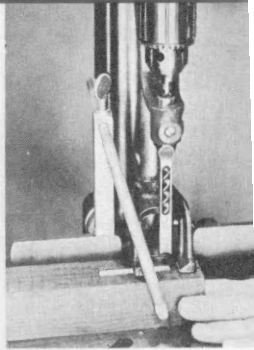
Large holes. Use lowest speed for drilling a large hole with expansive bit; strain is great. Clamp work securely, and advance drill slowly. If bit has lead screw, file threads away or they may pull the bit into the wood too rapidly and stall the spindle. Or else drill a pilot hole the diameter of the screw. These cutters work in hardwood, softwood, plastic, or sheet metal.

Glass. To drill glass, make bit from brass tubing with outside diameter the size of hole wanted. Cut off tubing at right angles; then cut slight slot in one end with hack saw. Block up glass on a flat board. Build dam of putty around hole position; then feed thin medium-grit valve-grinding compound within dam as tube is lowered lightly at medium speed.

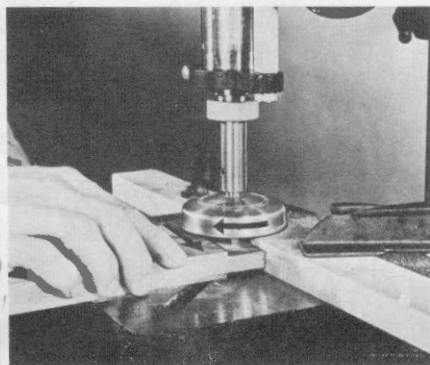




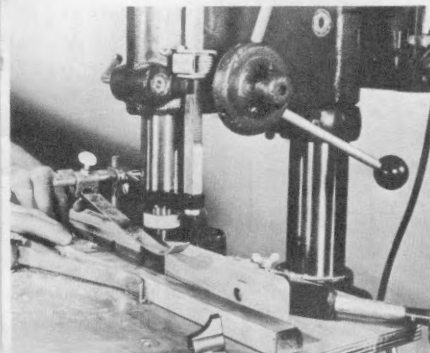
Surface planing. Primary use of planer attachment—an aluminum cup with cutters inside—is surface planing. Narrow boards or boards as wide as drill-press size can be planed to perfect smoothness with repeated passes. Pass the work through press against the direction planer is turning. Planer is also useful in truing dished or twisted boards, can be used for beveling, rabbeting, large inside routing.



Square holes, slots. Mortising attachments (fence, hollow chisel and bit, chisel socket, and hold-down) adapt drill press for cutting square, clean holes, and deep mortise slots. Control depth of mortise with depth gauge. In cutting mortise, move work sideways a little less than width of cut each time. Bit should be exactly even with chisel's cutting lips, or chips will be so large unit may overheat.



← **Tenons.** You can cut tenons to fit mortise slots with same rotary planer attachment you use to surface boards. To set length of tenon, clamp a guide block at right distance from front of cutter and lower quill to desired depth of cut. Feed work from left to right, so cutter holds work against fence instead of kicking it out. Turn work over and repeat to complete sides of tenon. Cut edge shoulders with saw. Use highest speed, and hold the work firmly.



← **Shaping, planing.** With special fence attached to table and cutters replacing chuck, drill press is efficient shaper. Feed work from left to right against fence. Spring fingers (one lifted to show cutter, like one on table) help hold work against table and fence. Use highest speed. With straight knives, cutter will edge-plane boards up to one inch thick. Use knob (right) to set the fence for depth of planing cut and then feed the work from left to right.

How to use a scroll saw

If you want to cut down on elbow grease and step up accuracy on home-maintenance jobs, the power scroll saw is a good place to start.

It is one of the safest power tools for home workshops, and also one of the easiest to use skillfully, the least costly to buy. It has no precision cutters to keep keen—only cheap blades to replace. Most of the popular makes use economical one-fourth horsepower motors.

A scroll saw will do a surprising number of things. You can devise jigs and attachments to spread its performance over such operations as sawing, filing, and sanding of wood, metal, or plastic; pattern cutting in stacks of paper, cloth, or leather; straight ripping of long boards. It can do nearly everything that a band saw can, but slower. It can do some things, such as filing and interior cut-

out work, that a band saw can't do.

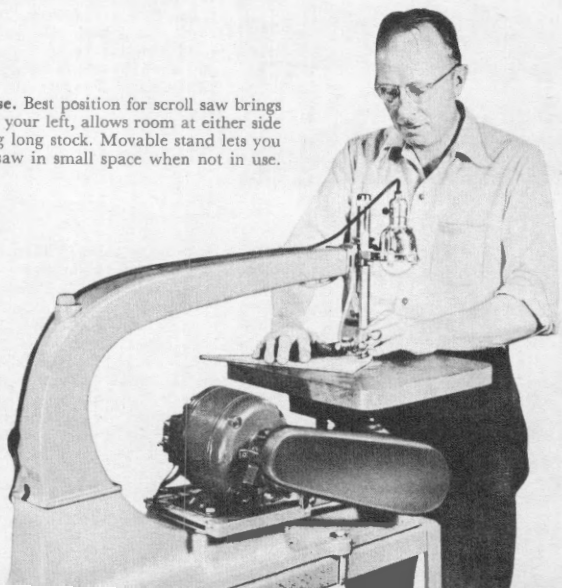
Basically, the scroll saw is a machine that jitters a fine saw blade up and down. Blades are thin; hence very sharp curves can be cut.

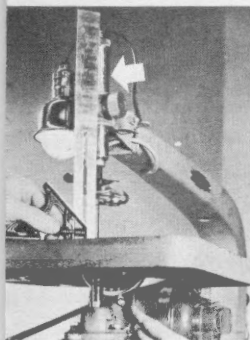
You can buy a little vibrator-powered scroll saw, which will do a lot of jiggling and jogging, for around \$10. Or you can get the kind of machine that factories use, complete with motor, for a little over \$100.

The base of the saw sweeps up and around, like a U on its side, to hold the upper spring and chuck which fasten to the top of the blade. The lower end of the blade is held in a chuck below the saw table; this chuck is part of the mechanism that moves the blade.

Scroll saws vary in working capacity. The smallest will take soft wood as thick as one inch; the largest will cut two-inch wood.

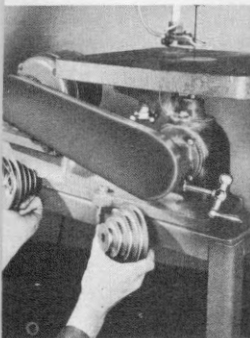
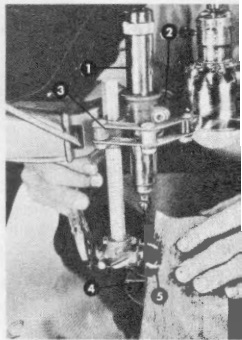
How to use. Best position for scroll saw brings light from your left, allows room at either side for ripping long stock. Movable stand lets you store the saw in small space when not in use.





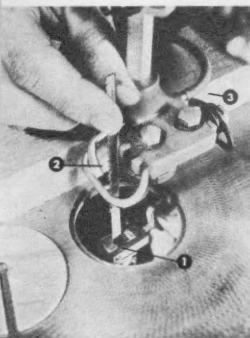
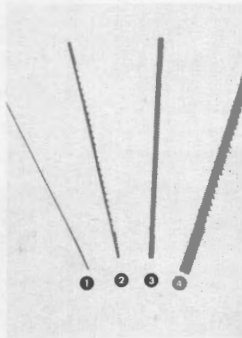
✦ **Maintenance.** Oil your scroll saw occasionally. Set the tension of upper spring (arrow) taut to keep blade being used from bowing. Check table angle with a try square sighted against the blade; table should be at right angles to blade when the scale below table is at zero. Then the tilt angles will be accurate on the scale.

Upper adjustable parts. Lamp swivels for easy positioning. Spring tension plunger (1) is calibrated to help you set it, locks by knob (2). Blade guide mechanism moves up or down through hole in arm (3). Presser-foot (4) locks level (or tilted for bevel cuts) at bolt being tightened. Curved bar (5) is safety guard for fingers.



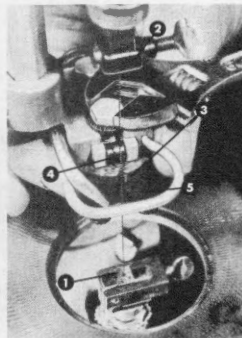
✦ **Speed adjustment.** Speed is adjusted by cranking motor back and forth on a variable-speed pulley mechanism (knob at right in picture), or by switching belt on four-step cone pulleys (held below). On cones, smallest motor pulley to largest saw pulley produces slowest speed. Use the lower speeds on hardwoods, some metals.

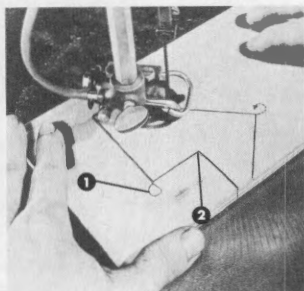
Blade types. Among blade types are: (1) Thin, fine-tooth blade for thin wood or metal, smooth cuts, sharp curves; (2) medium-thick with wide-spaced teeth, for plastic or bone; (3) coarse, with medium temper, for fairly heavy cutting; (4) saber blade, for heavy ripping, large curves. On softwoods use set teeth, or cut may clog.



✦ **Saber blade.** For heavy cutting and ripping, clamp a saber blade in the lower chuck only, and hold it with V-jaws (1) instead of flat ones. Note puffer pipe (2) connected to an air hose (3); the puffer keeps sawdust blown clear of the work.

Thin blades. Clamp thin blades in flat jaws of lower (1) and upper (2) chucks, teeth forward and pointing down. Revolve blade guide (3) until slot nearest size of blade is forward (use V for narrow blades), then lock. Set roller (4) to touch back of blade when cutting. Adjust whole guide mechanism on shaft (upper left) until presser-foot (5) holds work snug against table, yet free enough to move.

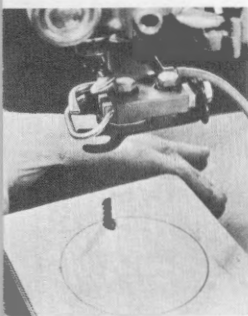




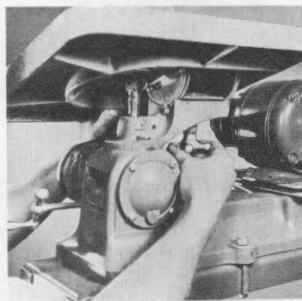
Sharp corners. If you try to turn too tight a curve with your scroll saw, the blade might bind and snap. So use the special cutting technique shown above when sawing corners. Detour each outside corner in a wide, circular sweep, cutting into waste wood (1). When you come to an inside corner (2), just round it; then square it off with straight cuts into the corner after the piece has been roughed out.



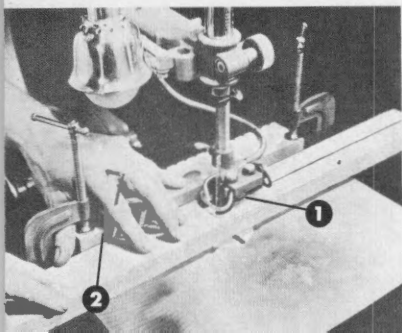
Internal cutouts. You can make internal cutouts without an entering cut. Raise guide high, release upper end of blade, and thread blade through a hole drilled in stock. Refasten blade, adjust guide, and proceed with sawing. On cutouts with sharp corners, first work into a corner with a single cut, back out, and go on with a smooth curve. Finish corner after you remove enough waste wood to maneuver.



✦ **Large cutouts.** To save time when you make a series of large, curved cutouts in heavy material, use a saber blade. Work can be dropped over the blade by simply raising the whole guide head, without the bother of having to detach and thread the blade for each cutout.

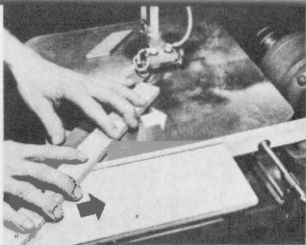


Bevel cuts. You can make bevel cuts of anywhere from 1 degree to 45 degrees. Loosen the clamping knob which holds the table, tilt table to the desired bevel angle as indicated on the built-in scale, and then tighten the knob again.

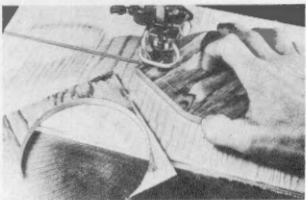


✦ **To rip long pieces.** Shift the whole guide mechanism (1) to the hole on the right side of the arm when you rip long boards. If you use an ordinary (not saber) blade, revolve the lower chuck $\frac{1}{4}$ turn so blade will be held at right angles to arm. Use C-clamps to fasten a straight board across the table at the desired distance from the blade, for a fence. This ripping fence (2) should be parallel to blade; it can be lined up parallel by measuring at several points from the edge of the saw table.

Guide jigs. For accuracy on both crosscutting and mitering, make guide jigs from scraps of wood. Pictured is a simple 45-degree miter jig, being used to guide work (dark wood) through saw. Extra piece of wood clamped to side of saw table isn't necessary unless table edge is rough.



Circles. You can cut circles that are almost perfect with simple jig. Make one by cutting a blade slot in a thin piece of plywood which can be clamped to the saw table. Place a phonograph needle or brad pivot in the jig at the same distance from the blade as the desired radius of the circle. The work revolves on this sharp pivot as you make the cut.



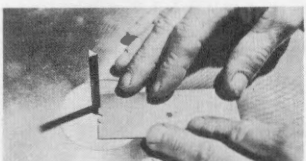
Improved circle jig. Many circles of various sizes can be cut rapidly with this modification of the circle jig. The pivot is placed on a sliding tongue of wood which can be moved to the desired radius and clamped in place. To adjust the simple plywood jig described above for larger or smaller circles, you can unclamp it and move it until pivot is proper distance from new blade.



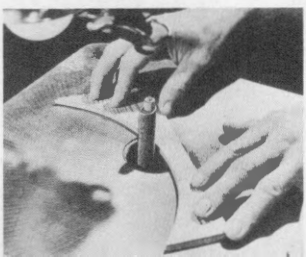
Paper cutouts. Many paper cutouts (for Christmas cards, party place cards, etc.) can be cut in one operation with a medium-fine blade. Stack the paper, place pieces of 1/4-inch plywood on top and bottom, and nail the stack together. Place the nails in the waste portion and clinch them deep so they don't interfere with the hold-down foot. Trace the pattern on top plywood piece and cut.

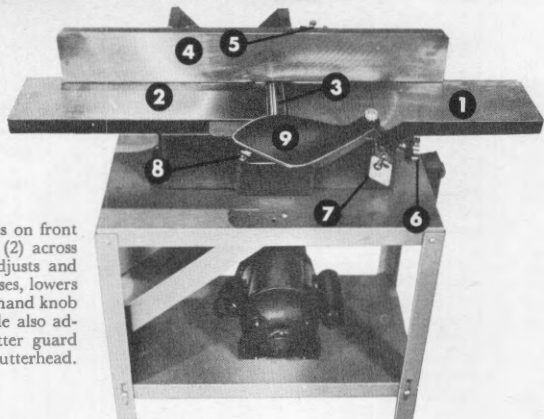


Power file. Clamp a small file in the lower chuck like a saber blade, and you have a power file. You can buy special files, or use a standard hand file as pictured. Use low speed, as high speed tends to fill up the file teeth with grit of the material being filed. Even the largest of the scroll saws will take up a space of only 3x1 1/2 feet in your workshop.



Sanding. Delicate sanding is also a side line of the scroll saw. Manufactured sanders like the one pictured expand from within to tighten the sandpaper sleeve. You can make your own sander by cementing a sheet of sandpaper to a dowel or to a whittled length of wood with stove-bolt shaft.





Main parts. Wood slides on front table (1) and rear table (2) across cutter (3). Fence (4) adjusts and locks (5). Front table raises, lowers by crank (6), locks with hand knob (7). Sometimes rear table also adjusts and locks (8). Cutter guard (9) is open to show the cutterhead.

How to use a jointer

A skilled craftsman can hand-plane the edge of a board to perfect straightness and square. But with a power jointer in the home workshop, anyone can do the same job with a fraction of the work.

Aside from this primary function, the jointer has other tasks within its scope. It will cut rabbets, chamfers, bevels, tapers, and tenons. It can make hexagonal or octagonal furniture legs, with or without taper. Or it can plane the surface of a board as well as the edge, and thus is often called a jointer-planer.

The jointer is much like its relative, the hand plane. Its only working part is a heavy steel cylinder, slotted to

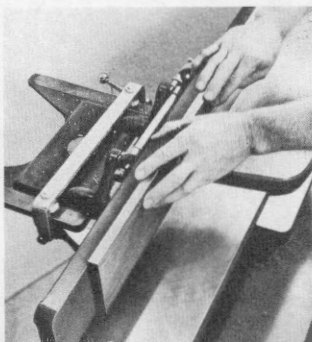
carry three straight knives. These knives are beveled, like hand-plane blades, to a keen edge.

Unless the rear table is stationary, it is set and locked at the same level as the blades just ahead of it for ordinary edge planing. The front table is cranked into a position as much lower than the blades as the thickness of wood to be planed from the board. A scale is provided to indicate depth of cut.

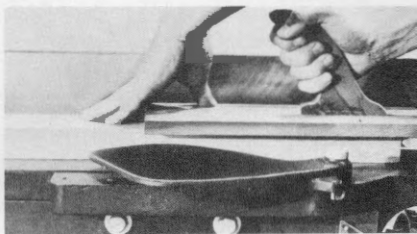
For safety, every jointer has a flat guard which covers the blades except for the part engaging the wood.

The price of a home-size jointer can range from \$40 to \$125, not including the motor.

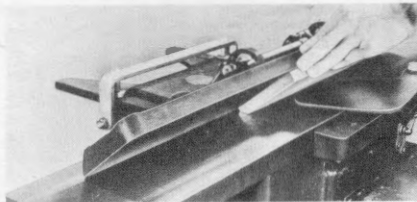
How to use. Primary job of the jointer is to plane board edges straight and square, often for gluing up large surfaces. Feed board along tables with hands held high away from knives. Hold it firmly against forward table with rear hand until halfway through cut, then press board hard against rear table with leading hand for rest of cut. Hooking little finger over edge of fence helps hold the board squarely upright, and keeps hand out of cutter.



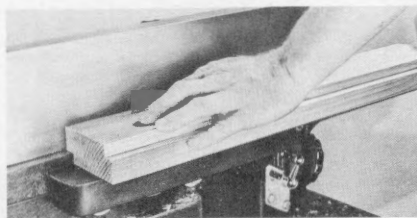
Surface planing. Board offers scant hand grip and hands are close to knives when you surface-plane. For safety, make a pusher hook like this one to hold the guide board. Without a hook or a pusher stick, don't try surface planing—it requires firm pressure, and fingers can easily slip. Plane end grain with successive light cuts, not in one deep cut that might chip work or throw it from hand. Proceed only two-thirds of way across board end; then reverse and complete the cut to avoid chipping edge.



Bevels. On most jointers, the fence which guides work can be tilted 45 degrees inward or outward, then locked. Cut bevels with the fence tilted forward to your left as you feed work into jointer. Wedging action of table and fence holds work securely for more accurate cuts than are possible with the fence tilted away from the blades. And you don't have to hold your hands on the flat surface of the board, too near the knives.



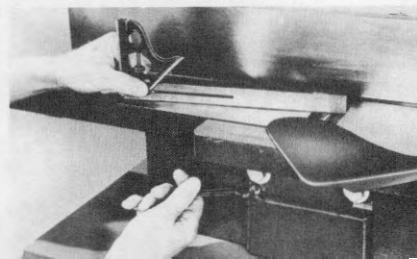
Rabbet. By sliding the fence in so only a short length of the knives is exposed, you can form a rabbet (a step cut along an edge). Remove cutter guard and set fence out to required width of rabbet. Then crank table down to desired rabbet depth. Large jointers will cut up to a 1/2-inch rabbet in one pass; smaller ones may need two or more lighter cuts to do same work. Fence on a jointer is higher than those on circular saws to prevent side tipping of a wide board.



Simple taper. To cut a simple taper, lower the front table the amount the board is to be tapered, minus a slight amount for the cleanup cut. Start the jointer, lower the leading corner of the board so it just touches the rear table, and feed the board through. When this initial cut has been made, line up front and rear tables and feed the board over the knives, the same as you would in smoothing any board edge, until the cut has been made to the marked line. (Cutter guard removed to show cut)



Adjusting. Adjust jointer by first setting rear table at exact height of knives' highest reach. To check, revolve cutter-head by hand; knife-edges should barely clear straightedge. Then lock rear table (sometimes stationary). Too low a setting gouges the end of cut; too high a setting cuts taper. Second, crank the front table level with rear, and set the depth-gauge pointer at zero. Third, use a square to lock fence at right angles; then set the fence gauge at zero.



How to use a wood-turning lathe

You can give your home workshop projects a master craftsman's touch without endless hours of work or years of woodworking experience.

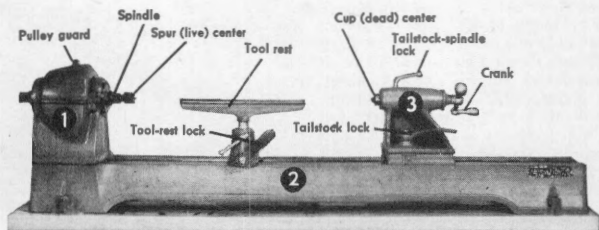
The power tool that will do the job is the wood-turning lathe. When you make circles or discs, cylinders or cones, columns, dowels, or even knobs and spools, the lathe is the best (often the *only*) machine to use.

Basically, the wood lathe spins unround pieces of wood, while hand-held tools shape the wood into various round forms. For all work a tool rest supports the cutting tools.

Long pieces are held between two pivots, much as a cob of corn is held

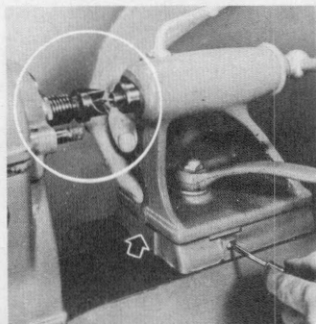
on skewers for eating. Pivot at the left is the "live center" which spins the wood; the "dead center" pivot at the right merely supports the work. Flat work—wheels, dishes, trays, and such—is turned without the use of the dead center. It is held by a flat metal disc which locks in place at the live center.

Accessories can be obtained to fit the wood-turning lathe for other jobs—turning solid metals, spinning sheet metals, turning plastics, grinding, sanding, buffing, drilling, and polishing. Cost ranges from about \$30 without motor to around \$200 for a large lathe with heavy-duty motor.

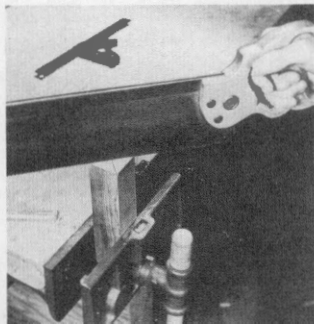


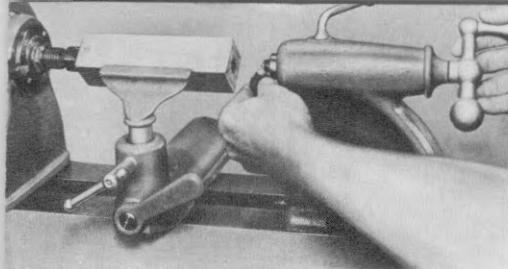
Lathe parts. Mount your lathe on a bench, counter, or special stand. Stand is best. It simplifies placement of motor, keeps accessories in order. Major parts of lathe include the headstock (1), bed (2), and tailstock (3).

Line up centers. To check alignment of centers (circled), close gap until cup center (right) nearly touches spur center (left). Then lock tailstock, and use adjustment screw to set tailstock at zero mark (arrow). Then centers should coincide.

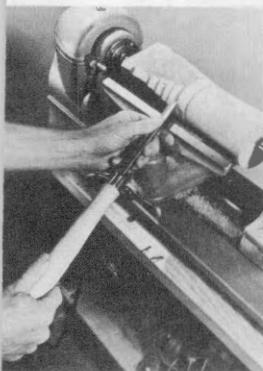


To find centers. Locate exact centers on square piece to be turned by penciling straight lines from opposite corners across each end. Intersection of "X" is center. For spur center (live center on headstock) cut shallow saw slots on the marked lines.



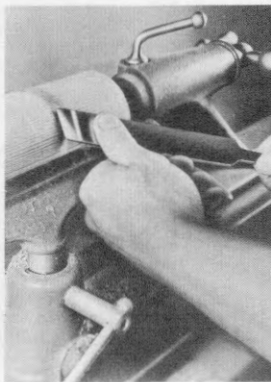


Placing block. First tap spur center into place in headstock spindle with mallet on block of wood. Then slide tailstock (right) into position. Before cranking cup center into end of work, lubricate cup as pictured using beeswax, paraffin, or candle. Lock tailstock spindle and tailstock after setting cup center in work.



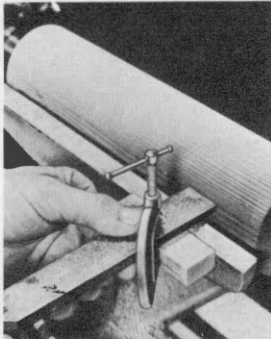
← **Roughing cuts.** First cuts to remove square corners are made with gouge. Use low speed for hardwoods or large diameters, higher speeds for softwoods or small diameters. Lock tool rest $\frac{1}{8}$ inch above center and close to work. One hand, forefinger against tool rest, grips shaft of gouge; hand at handle angles tool point so cutting action is paring, not scraping. Slide tool across rest as block spins, taking light cuts.

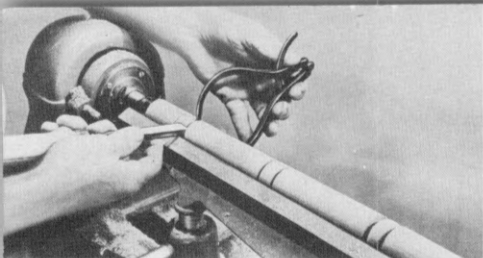
Smoothing cuts. Make smoothing cuts with a skew chisel, angling it to produce a shaving cut. Lower third of edge does cutting. Use next-higher speed than for roughing cut, and take light cuts. →



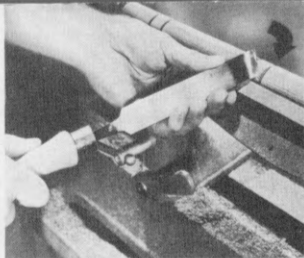
← **Use ordinary plane.** An ordinary block plane can also be used for smoothing after the roughing cuts are made. Hold it diagonally, as shown, to produce a smooth shaving cut. A wider area of plane blade and bottom in contact with work gives a straighter cylinder.

Scraping chisel. Extremely accurate cylinders can be formed with a square-nosed scraping chisel, to which a block has been clamped as a guide to follow tool rest. Cut will not be as smooth as that of the skew chisel, so finish with coarse, then fine, sandpaper. →



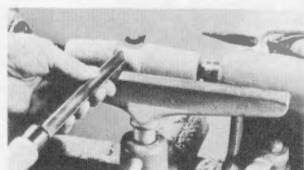


Parting tool. Roughing-in cuts for beads, coves, or shoulders are made with a parting tool. It is held like gouge or skew, advanced straight into work. Here it is advanced with one hand while calipers, preset to desired diameter, are held to work. Stop cut as soon as calipers lip over work.

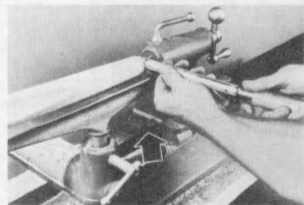


Forming bead. After making initial depth cut with parting tool, use skew chisel to form the bead. For such a shape, begin cut with heel point and rotate the tool inward and downward toward bottom of depth cut.

Coves. Concave curves, called coves, are cut with ➤ gouge. They can be scraped, with gouge held flat throughout cut. But you can make a cleaner cut by starting with gouge tipped on edge as shown, then rolled toward a flat position as the cut progresses. Hold tool firmly, since slightly wrong angle may carry a lightly held tool off on a spiral, marring cut. Make a pattern to hold against the work occasionally to check accuracy of cut.



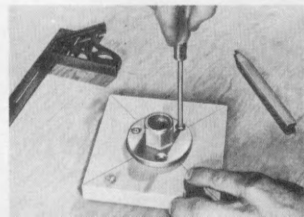
Tapers. Tapered cuts appear complicated, are ➤ simple to make with lathe. Work is mounted as usual, then the tailstock is set off-center (forward) one-half the amount of taper in entire length. Here, center marks show amount of offset (arrow). A straight cut following the tool rest, which parallels lathe bed, then produces the desired taper. Taper can also be cut freehand, checking the cut frequently with straightedge and calipers.

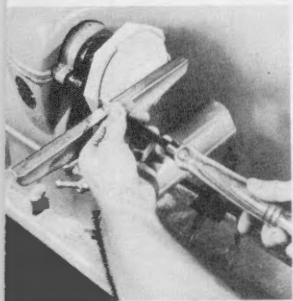


Final cut. Finished work must be cut off from ➤ waste stock at both ends. Use point of skew chisel. Take light cuts, alternating between straight-in shoulder cut and conical cut to make room for chisel. Work alternately between live and dead centers until only slim shafts hold work. Then cut gently through dead-center end first, with one hand ready to catch freed piece. If live-center end does not break free, it can be cut deeper, then broken free. You can sand both ends clean later.

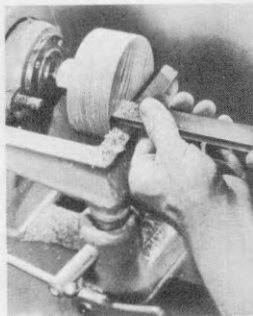


Mounting flat block. Flat work to be turned is ➤ supported by the headstock alone. Center of square piece is determined by drawing lines from opposite corners. Fasten piece to faceplate with short, heavy screws; then saw off waste corners before attaching faceplate to headstock spindle.

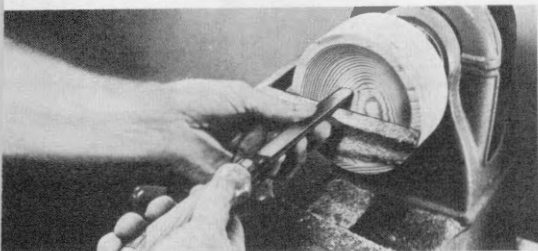




✦ **Cut circle.** Rough octagonal piece is cut to diameter at low speed, using dividers to measure and parting tool to make cut. Tool rest is set below center (unlike setting for work between centers), so scraping cuts will be made along a line even with center of work.

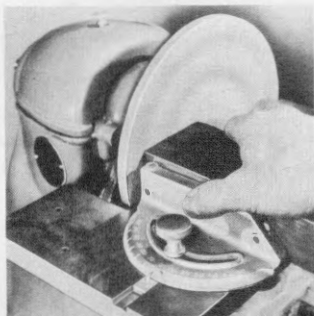
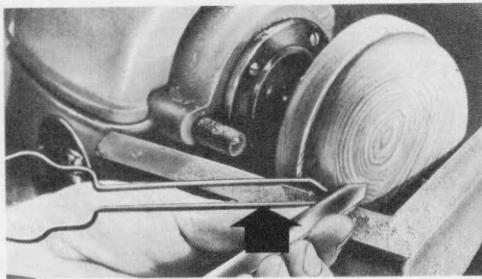


✦ **Flat facing.** Use the square-nosed scraper for flat facing. Let your hand follow the tool rest to guide a perfectly flat cut, or clamp on a block, as in making a straight cut between centers. Check flatness of the piece with a straightedge.



✦ **Concave curves.** Form concave (inward) curves with roundnose scraper. Cut the curve by pivoting the tool on the rest and drawing it around the curve so the tool is always a radius of the circle. For safety in cutting the original circle from the rough block, stop the lathe when the parting cut is nearly through, and break off waste wood by hand. Otherwise, scraps may be thrown wild by spin of lathe.

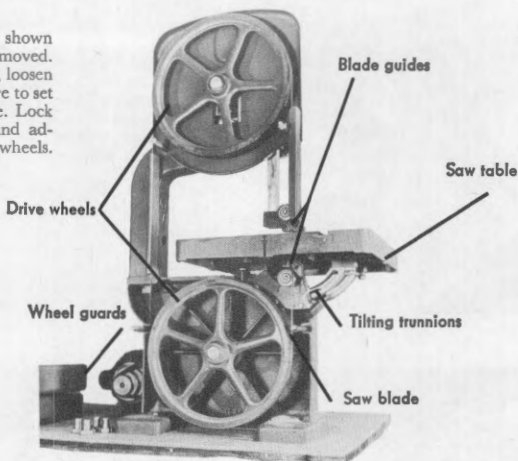
✦ **Convex curves.** To cut convex (outward) curves, scrape with square-nosed tool or the spear-nosed pictured. An outline of the spear-nosed tool (arrow) shows shape of its cutting edge. As in concave curve, convex curve is cut by pivoting tool on rest and drawing it around the curve with its straight cutting edge always tangent to the curve. Face-plate cuts, where most of thrust is straight down on tool, don't require as firm a grip on chisels as between-center cuts require.



✦ **Disc sanding.** A disc sander, with table and miter gauge to fit, is a standard accessory. Table clamps to lathe bed, and disc attaches to headstock spindle. Miter gauge assures accuracy. Size of a lathe is designated by the "swing"—diameter of largest circle which can be turned. A large home-shop lathe has a 12-inch swing, and the longest piece of work which can be turned is about three feet.

Mechanism. Band saw is shown with wheel enclosures removed. Blade rides wheels. To adjust, loosen blade guides, then use a square to set table at right angles to blade. Lock table, set tilt gauge at zero, and adjust blade guides and support wheels.

How to use a band saw



For cutting graceful and intricate curves in a thick piece of wood, no home-workshop power tool can surpass the band saw. Without it, your mechanized workshop will be limited.

The band saw will cut much heavier material than the scroll saw, and do it faster and smoother. It will make straight cuts as well as curved.

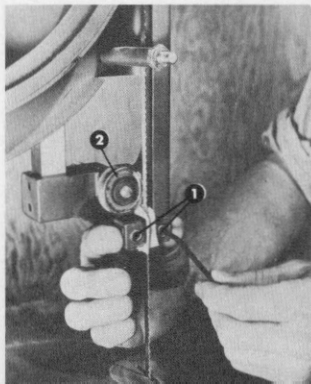
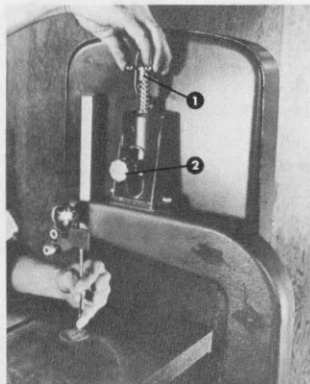
The wheels of the band saw propel the blade belt-on-pulley fashion, so

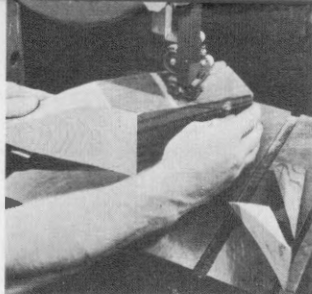
that its downward-pointed teeth travel continuously downward through a hole in the saw table. Cutting action is smooth and free of vibration. Blades are easy to change; they vary in width and coarseness of teeth.

All moving parts of the saw—blade and wheels—are enclosed in metal housings, leaving only 6 or 8 inches of blade exposed. Prices range from \$50 to \$100, less motor.

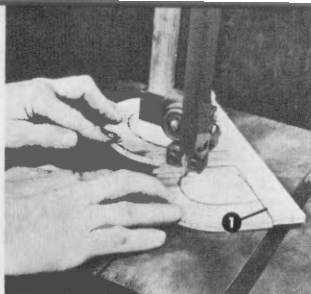
Blade adjustments. Use upper wheel to adjust blade. Turn knob (1) until blade is taut but will spring a bit between fingers. With saw running, adjust wheel tilt (2) until blade rides on center of wheel tires.

Blade guides. Set blade guides (1) as shown, using scraps of paper as spacers. Lock upper and lower sets, then remove paper scraps. Allow 1/64-inch space between back of blade and support wheel (2).





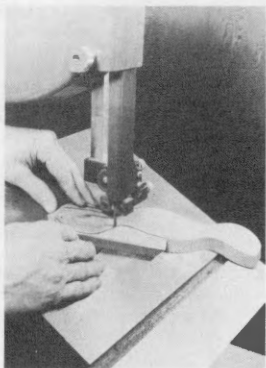
Compound curves. You can cut compound curves on a band saw. Working from a square piece, cut first curves and tack waste pieces back in place. Then turn stock sideways and cut second curve. Use heavy, coarse-toothed blades for thick material, or for any rapid cutting.



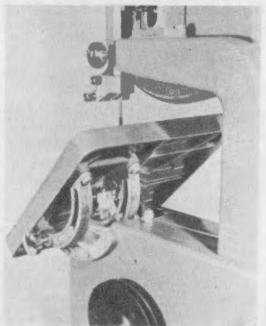
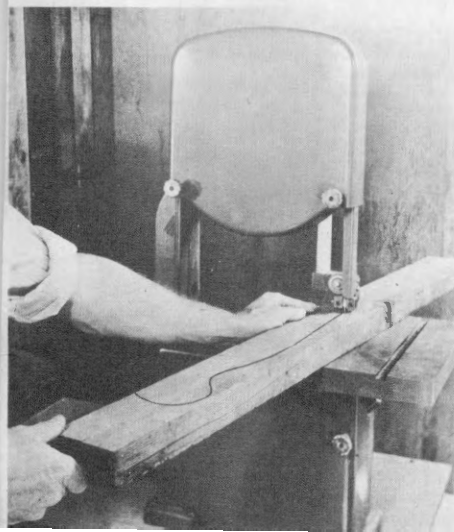
Entering cut. Unlike the scroll saw, an internal cutout with the endless band-saw blade requires an entering cut (1). Width of material is limited by the distance from blade to side arm — usually 10, 12, or 14 inches. This is equal to the diameter of the wheels over which blade is stretched.

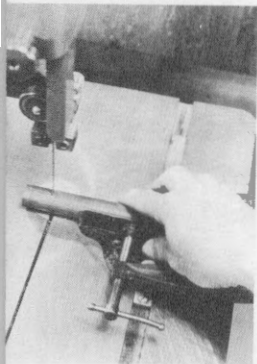
Beveled curves. To cut beveled curves, you can tilt table to any angle up to 45 degrees. Some tables will tilt a few degrees to the left, as well, to allow easier adjustment of the blade guides beneath. To install a blade, remove guards and crank top wheel down. Feed blade through table, teeth pointing down and stretch over wheels. Adjust blade tension and guides.

Long curves. You can cut long curves in heavy stock most easily and quickly on a band saw, and the length of the cut is limited only by the size of your shop. A 12-inch saw will slice rapidly through a block $6\frac{1}{4}$ inches thick. A piece much longer than the one shown would call for the help of an assistant, or else a roller support placed at the far side of saw table.

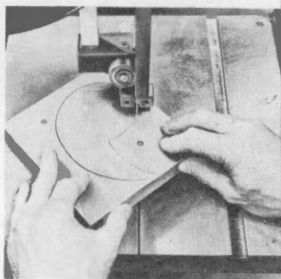


Tilting table. Saw table tilts on pair of trunnions beneath it, and locks with hand knob (left) at angle desired for making a beveled cut, straight or curved. Note lower blade guides beneath table. A narrow blade will cut a sharper curve.

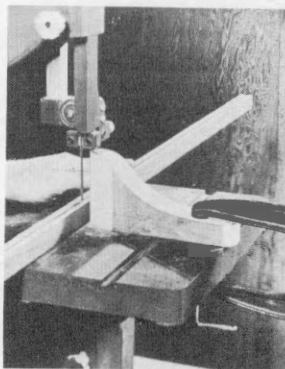




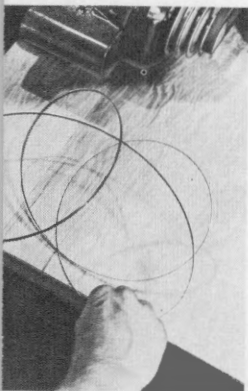
➔ **Cutting sheet metal.** Thin sheet metal can be cut on a band saw, but avoid ragged edges on the underside by using a piece of waste wood as a backing board. Tack metal to wood (through waste portions) and make the cut. The wood stiffens the metal for a clean cut. For all metal work, use a special metal-cutting blade.



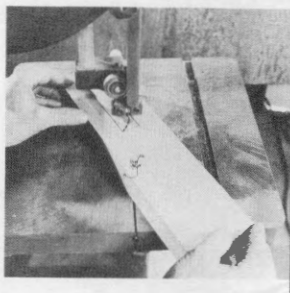
➔ **Miter gauge.** An accessory that increases accuracy of work done on a band saw is the miter gauge. Here it is used with a C-clamp to cut accurate sections from a length of copper tubing. For cutting curves, use a thin blade. The narrower the blade, the sharper the curve it will cut. The finer the teeth, the smoother the blade cuts.



➔ **Straight cuts.** A band saw rips straight cuts with fair accuracy. If blade deviates from straight cut, make a fence with a single contact point, like this; it allows slight steering of stock. If blade tracks true, you can use a long fence like that of a circular saw.



➔ **Folding blades.** To fold for storage, hold blade at middle points, teeth up. Roll hands inward, twisting blade, at same time hooking far side of loop under edge of table to help force loop downward. Continue to twist and bring hands together until blade forms triple loop. Slide loops on to table; they will enmesh, lie flat.



➔ **Sharp corners.** You can't turn sharp corners with a band-saw blade; it has to enter, then back out and start from another point to complete pattern. The curve shown will be completed by second cut marked, with nibbles of the blade to eat out the triangle.

Put Safety First with Power Tools!

Controlled power is safe power. But power in the hands of a careless person is a dangerous thing.

Your handsome power tools won't give you much satisfaction if they mean a high doctor bill, or leave you minus a finger or two. So handle them with care. Learn everything you can about each machine. Study instructions, and study the machine, until you know just what it can do and what it can't do.

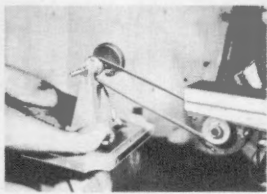
Then use your power tools with these precautions in mind.



Rule 1. Don't reach toward the cutting edges of a machine until the power switch has been turned off and blades have stopped moving.



Rule 2. Don't skip goggles or face shield if there's danger of flying splinters—especially if grinding.



Rule 3. Keep belts on motors as short as possible. Arrange them out of way, or cover with guards.

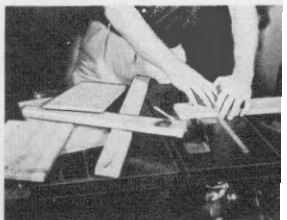
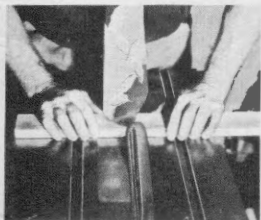


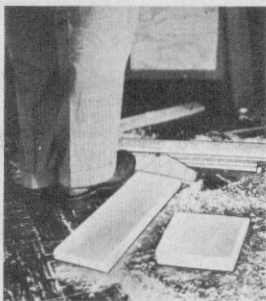
Rule 4. Don't let children get near machines. Ban them from shop.

Rule 5. Don't wear clothing that might get caught in machines. Roll sleeves up and out of the way. Also remove rings, watches and identification bracelets.

Rule 6. Don't forget to use the safeguards built into your power tools. Never rip a board with a circular saw without putting the metal guard in place over the blade.

Rule 7. Don't do work in cramped quarters. Have plenty of room to work in and you will avoid accidents. Have a box for scraps, and dispose of them as they accumulate.





Rule 8. Don't allow your workshop to become cluttered with scraps and shavings. Clean floors are essential; you need firm footing and good balance at all times.



Locking switch. If children are about the shop, this switch is a good idea. The tool cannot be turned on until the key is turned in the switch.



Rule 9. Don't have your switches anywhere except on the machine. Reaching to disconnect is hazardous. If necessary, cut a simple line switch into cord near the machine.

Rule 10. All power tools should be grounded, either at the frame by a grounding wire, or at the plug by a 3-wire conductor. This is for your protection in the event that a short circuit should develop in the tool or switch.

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FOR EMPLOYEES**